Summary Report
Enhanced Evaporation Pilot Test

Anaconda Mine Site
Yerington, Nevada

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Executive Summary

Singatse Peak Services LLC (SPS) performed a pilot study to evaluate whether enhanced evaporation could be used to extend the life of the fluid management system (FMS) at the former Anaconda Mine Site (Site) in Yerington, Nevada. The FMS is part of Operable Unit 8 (OU8) and includes the collection and management of residual drain down fluids from heap leach pads that were last operated in 1999.

The legacy environmental liabilities of OU8 are considered an orphan share with no responsible party to fund the permanent closure of OU8. Atlantic Richfield Company (ARC) currently operates the FMS under various Orders with the USEPA. SPS has been performing mineral exploration in Yerington since 2007 and at the Anaconda Mine Site since 2011. In December 2015, the USEPA proposed the Site for listing on the National Priorities List (NPL) to pursue closure funding under Superfund. One of the main drivers for proceeding with NPL listing was the concern that the FMS was running out of capacity, as early as 2019, without a funding mechanism in place to implement a permanent solution.

Given uncertainties with the timing and outcome of NPL funding for the site, SPS decided to voluntarily proceed with the enhanced evaporation pilot test as a means to extend the life of the FMS. If enhanced evaporation were shown to be successful, it would allow additional time for SPS to continue its mineral exploration and development activities at the Site and nearby prospects, and extend the time required to secure alternative funding for the permanent closure of OU8.

The pilot test was performed in accordance with a work plan that was approved by USEPA and NDEP. This document summarizes the technical results of the pilot test. It also summarizes key parameters that would be used to design and operate a full-scale system which would eliminate FMS capacity concerns for at least 10 years in a safe and cost effective manner.

Items defined from the pilot test include design, construction and operating requirements for successful implementation of a full-scale system. Specific criteria discussed in this report are irrigation panel layout, sprinkler head selection, pumping and piping requirements, optimal fluid application rates, estimate of evaporation rates, identification of key risks and mitigation, and estimated capital and operating costs.

The pilot test has shown that enhanced evaporation is a safe and cost effective means to manage the residual draindown fluids from OU8. The pilot test results show that enhanced evaporation would extend the life of the FMS by 10 years with no net accumulation of FMS fluids. It was also successful in collecting empirical data for design of a full scale system that would be low maintenance and cost effective. Enhanced evaporation would allow for additional capacity of the FMS thereby providing additional time to find alternative means of funding a permanent solution for closure of OU8 while ongoing mineral exploration and development continues at the site.

1.0 Introduction and Background

This report provides the details of the enhanced evaporation pilot test that was performed by Singatse Peak Services, LLC (SPS) at the Anaconda Mine Site located near Yerington Nevada. The pilot test was completed in accordance with the Work Plan for Enhanced Evaporation Pilot Test (SPS, 2016) to evaluate whether enhanced evaporation could be used to increase the capacity of the OU8 Fluid Management System (FMS).

The volume of drain-down solutions has significantly decreased since Arimetco operations ceased in 1999, as of 2014 averaging less than 10 gpm. Even with the reduced volume of drain-down solutions, it has been estimated that the existing FMS ponds may run out of capacity by 2019.

Discussions between EPA, NDEP, ARC, SPS and local community stakeholders regarding a State-lead approach to overall site closure began in early 2015. A key driver for these discussions was the fact that the legacy environmental liabilities of OU8 are not funded, referred to as an orphan share. In December 2015, the USEPA proposed the Site for listing on the National Priorities List (NPL) to pursue funding under Superfund. One of the primary concerns for proceeding with NPL listing was that the OU8 FMS was running out of capacity, as early as 2019, without a funding mechanism in place to implement a permanent solution.

Given the uncertainty around NPL listing and securing Superfund dollars for closure of OU8, SPS voluntarily offered to perform an enhanced evaporation pilot test to increase the capacity of the FMS ponds. This would provide additional time to secure alternative funding to close the OU8. If the results of the evaporation pilot test are successful, the capacity of the FMS could be extended 10 years or more, providing additional time to secure alternative funding to close OU8 while SPS continues to evaluate restarting mining at the site.

2.0 Project Team Roles & Responsibilities

Singatse Peak Services, LLC (SPS) took the lead role in planning, designing, constructing and operating the enhanced evaporation pilot test. The field work was coordinated with EPA, NDEP, BLM and ARC in accordance with the work plan. SPS hired a local Yerington contractor, Desert Engineering, to assist with building and operating the pilot test.

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During the pilot test, ARC continued to operate the FMS except for SPS's removal of fluids from the VLT pond to feed the enhanced evaporation system.

3.0 Overview of the Pilot Test

This section summarizes the work that was performed during the pilot test. Detailed descriptions of OU8 and other site components are not discussed in this report since this information is available in numerous reports prepared by others (CH2M Hill, 2012, Brown and Caldwell, 2016). The primary components of the FMS are shown in Figure 3-1.

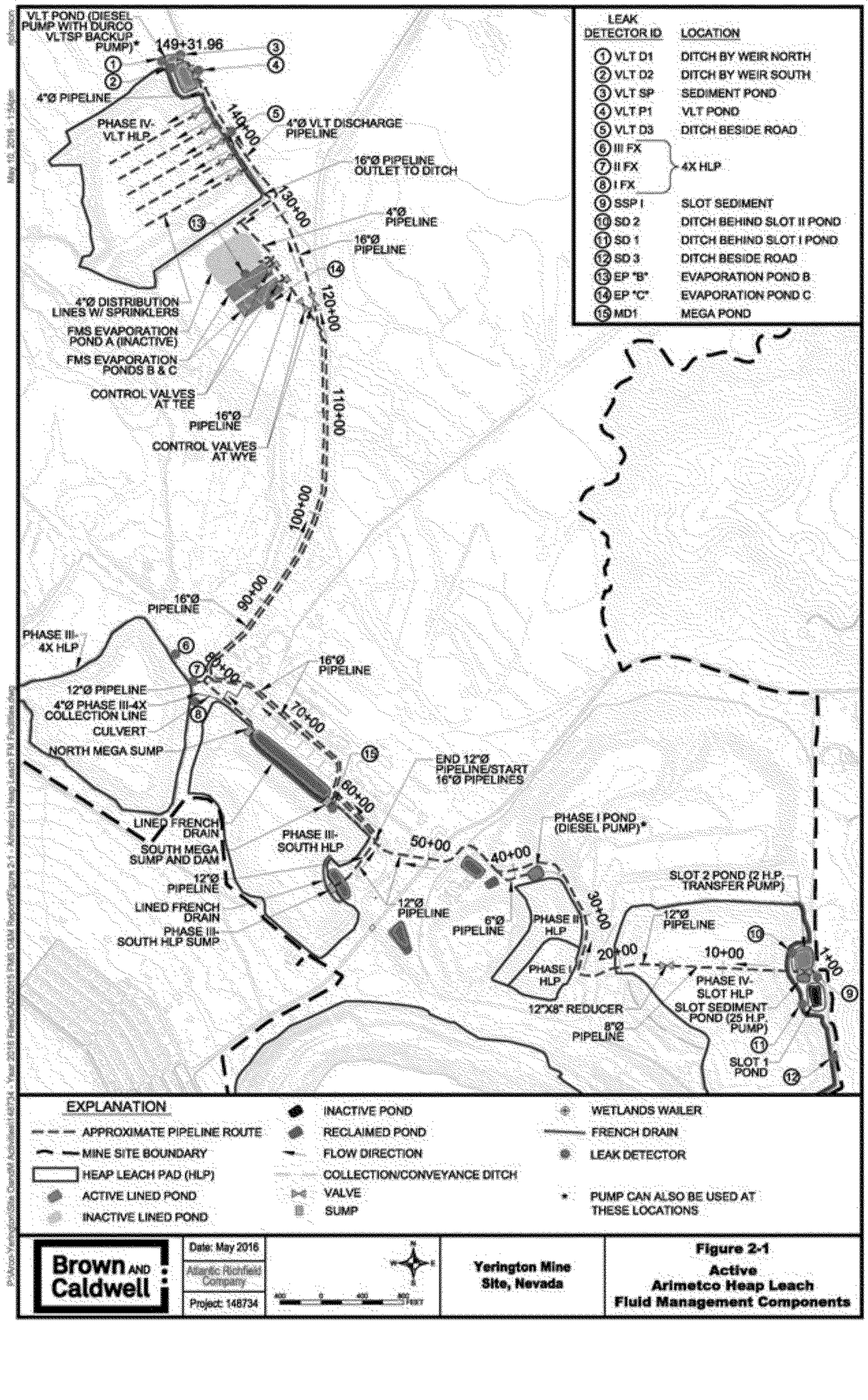
The primary objective of the pilot test was to obtain empirical data that could be used to design a full-scale enhanced evaporation system that would extend the life of the FMS. In the work plan, qualitative performance criteria to define success of the pilot test were identified in three categories; water balance, maintenance, and cost effectiveness.

Criterion #1, Water Balance - The performance of the pilot test indicates that enhanced evaporation is technically feasible to design and operate a full scale system that will evaporate enough fluid to achieve zero net annual fluid accumulation in the active ponds over next 10 years. Based on historical pond level data, it is conservatively estimated that up to 1.5 million gallons of fluid would need to be removed from the system to achieve the goal of no net fluid accumulation. This estimate may be revised following completion of the updated water balance as part of the 2016 Annual O&M report for OU8.

Criterion #2, Maintenance - The maintenance required to achieve the successful water balance result above is technically achievable without excess labor or other cost. Prior to running the pilot, it was anticipated that buildup of precipitates could cause clogging of the sprinkler heads. Sprinkler head maintenance was shown not be an issue during the pilot test. There was essentially no buildup of precipitate at the sprinkler heads. Routine maintenance was performed on the main pump and to repair minor pipe leaks that occurred during the pilot test.

Criterion #3, Cost Effectiveness - The costs to build, operate and maintain a full scale system are in-line with the benefits that the system would provide. The cost/benefit tradeoff of using Enhanced Evaporation compared to other alternatives depends on several factors related to funding and timing associated with reclamation of the overall site. For example, if NPL or other funding becomes available for permanent closure of OU8, the benefits of operating an enhanced evaporation system may be low. However, if funding is not in place and the pond levels continue to increase, the benefits of enhanced evaporation may be high. Estimated capital and operating costs are provided in Section 9.

Figure 3-1. Major Components of the OU8 Fluid Management System (Brown & Caldwell, 2016)



4.0 Design

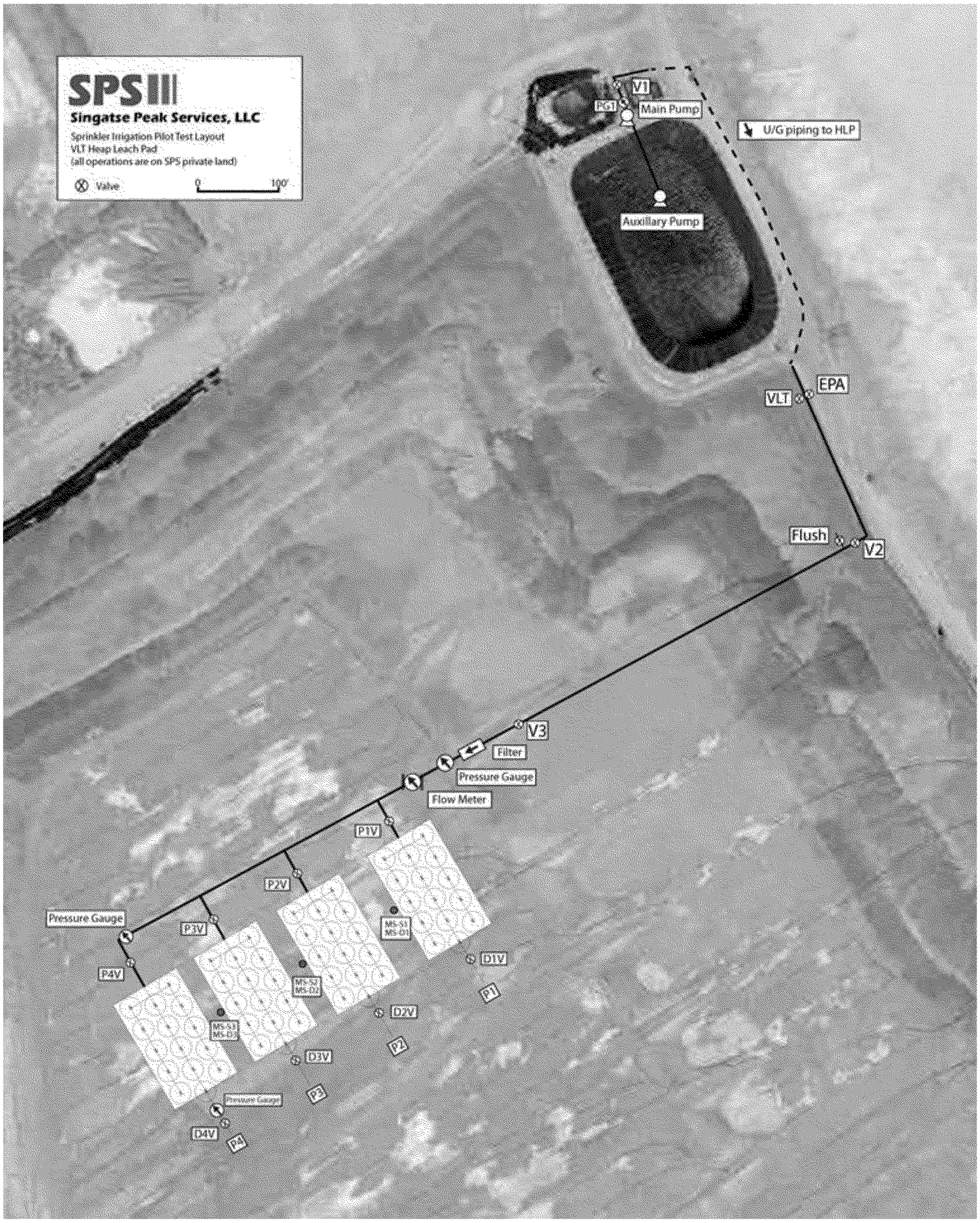
The irrigation approach involves pumping fluids through a system of pipes to the sprinkler heads. At each sprinkler head, the fluid is sprayed into the air through a nozzle that breaks the fluid into small droplets. The droplets then evaporate in the air or fall to the surface of the lined VLT HLP. The pump system, sprinklers and operating procedures were designed to uniformly apply fluid to the soil. This was accomplished by distribution lines that were connected to a manifold piping system at pre-determined spacing. Spacing of the sprinkler heads was selected to achieve optimal evaporation based on the anticipated pressures and specifications provided by the manufacturer.

The use of both sprinkler irrigation and a water truck were discussed in the work plan. Given the early success shown with the irrigation approach, the water truck approach was not tested during the pilot test. Two types of sprinkler heads were evaluated during the pilot, with the performance clearly better with the stainless steel Bete heads. Therefore, early in the pilot, all heads were replaced with the Bete heads.

Through discussions with ARC, the existing 25 hp Durco electric pump was used for the pilot test. Based on the Durco pump specifications, it was determined that an auxiliary pump was needed upstream of the Durco to provide adequate pressure at the sprinkler heads. Therefore, a new 13 hp floating auxiliary pump was placed in the VLT pond to achieve the required operating pressures. The pump specifications and pump curves are provided in Appendix A.

All operating pressures of the pilot test were designed to be well within the pressure specifications of the sprinkler head, existing and new piping, and other components of the system. The operating pressure at the sprinkler heads was designed to be between 30 and 40 psi. To account for head losses in the piping and the elevation change between the pump and the sprinkler heads, the operating pressure at the discharge side of the Durco pump was set between 120 and 140 psi. This allowed for approximately 90 to 100 psig pressure to account for the difference in elevation between the VLT pond and the top of the VLT HLP. The design rates were provided as a range to account for uncertainties associated with pumping high TDS (and therefore high specific gravity) FMS fluids. In addition, a bypass valve and associated piping were added to the discharge side of the main pump that functioned to allow for variable flow at constant pressure. The system layout is shown on Figure 4-1.

Figure 4-1. Enhanced Evaporation Pilot Test Layout



The VLT HLP was selected for the pilot test because piping was already in place and the top of the VLT HLP is relatively level, requiring minimal site preparation to accommodate the pilot test. Based on the pump and sprinkler specifications, the evaporation panels were designed to be 90 ft wide by 150 ft long. Using four panels, this resulted in a total of 60 sprinkler heads, each putting out approximately 2.4 gpm at 40 psig. The estimated diameter of coverage at each sprinkler head was 30 ft and the design also allowed for 30 ft between each panel. This provided an effective area of the pilot test of 67,500 ft2 (approximately 1.5 acres).

The existing 4-inch HDPE pipe was used from after the discharge side of the main pump from where the piping goes underground up to the top of the VLT HLP. New SDR 11 piping was installed on top of the VLT HLP. Piping in the new panels on top of the VLT HLP was designed with 2 inch HDPE pipe. The sprinkler riser pipe was designed with Schedule 40 PVC. The piping and valves were designed such that between one and four panels could be operated at the same time allowing for operational and maintenance flexibility without shutting down the entire system. It was demonstrated during startup that all four panels could be efficiently operated at the same time. Flow meters and pressure gages were installed at key points in the system. An in-line filter was installed in the 4-inch diameter pipe at the top of the HLP upstream of the sprinkler manifold.

Initial predictions of the fluid application rate based on literature reviews and discussions with other operators of similar systems indicated that it could be possible to achieve a rate of application equivalent to approximately 0.5 inches/day of 'precipitation'. Given the pumps and sprinkler heads that were selected, this was reduced to 0.25 in/day prior to startup. To accommodate the design daily rate of 10,000 gal/day, the panels were initially designed to operate at 30 to 40 psig at the sprinkler heads, requiring 120 to 140 psig at the main pump outlet. This required pumping for approximately 1.5 hr/day. Following pumping, the system was allowed to rest to allow for near-surface evaporation to occur.

Pressure gages were installed downstream of the pump, at the upstream side of the sprinkler manifold and at the farthest downstream end of the system. The gages were selected to be compatible with low pH fluids and the anticipated design pressures. Based on suggestions from the sprinkler head manufacture and actual performance, it was determined that pressure regulators were not required.

To better understand fluid evaporation and retention in the upper few feet of the HLP, soil moisture sensors were placed beneath each evaporation panel. The sensors were set at depths of 1.5 and 3 ft, which was estimated to be within the evaporation zone of the HLP surface. Data produced by the sensors was inconsistent. After a field visit by the manufacturer, it was determined that the composition (coarse grain distribution with limited fine grained soil) of the VLT HLP material did not provide the necessary contact with the sensors.

5.0 Construction

The piping and sprinkler layout is shown in Figure 4-1. Manufacturer data sheets and specifications of the equipment used for the pilot test are provided in Appendix A. The sequence of construction was as follows:

- Minor grading to improve access to the top of VLT HLP.
- Survey and stake the test location
- Level the test area with a dozer to minimize ponding. A perimeter berm was already in place around the top of the HLP so there was no risk of run-off from fluids applied during the test.
- Modify existing piping
- Install new piping, valves, pressure gages, flow meter and in-line filter
- Install piping to connect the auxiliary pump to the Durco pump

A geomembrane liner was placed beneath the pump so that potential leakage would be on containment. As discussed previously, the pump selected for the pilot irrigation test was the existing 25 horsepower electric pump (Durco) that has been used by ARC at the VLT pond as a backup pump. Given the Durco pump characteristics, a new auxiliary pump was installed in the VLT pond and used to increase the ability of the Durco for pumping fluid to the top of the HLP. The Durco pump discharge piping was modified to connect into the existing header pipe. In addition, a bypass valve and piping was added to the discharge side of the main pump that allowed for variable flow at constant pressure.

Photo-documentation of the major items of construction is provided in Appendix B.

6.0 Startup and Operation

<u>Health, Safety and Environment (HSE)</u> - All field activities were performed in accordance with SPS's Safety, Health, Security and Environmental (SHSE) Manual. SPS also followed ARC H&S plans and protocols when pilot study operations require access to ARC work areas.

Minimum PPE requirements required for the pilot test included hard hats, safety glasses, steel-toe boots, high visibility and long sleeved shirt and leather work gloves. Additional PPE was used specific work tasks when there was potential for contact with low pH solutions and included Tyvek coveralls, rubber boots, side shields on safety glasses and nitrile gloves.

<u>Startup</u> - Some of the piping that was used in the pilot test was not located on top of existing containment. For example, the existing above and below grade piping located between the pump and

the VLT perimeter ditch was used which is not on top of a liner. As a precaution and prior to pressurizing with low pH fluids, the entire piping system was pressure tested with clean water. Any leaks were repaired prior to the start of the pilot test.

While the system was pressurized, there was full time oversight to allow for immediately shutting down the pump in the event of a leak. During the pilot there were no leaks that occurred in the piping that was outside of containment. Several minor leaks were observed on containment areas in the perimeter ditch and on top of the HLP, which were repaired as they were found. All leaks were documented on the daily observation forms provided in Appendix C. Detailed startup and operations procedures are provided in Appendix D.

Operations - During the pilot test, an adaptive management approach was used to achieve the objectives of the pilot test. Adaptive management starts by predicting the performance based on best judgement or previous experience, designing and implementing the alternative, monitoring to assess and understand performance, and then use the early results to adjust the operations. This resulted in an iterative approach to optimize the application rates during the pilot. For example, fluid application rates (i.e. flow rates) were monitored and adjusted to optimize evaporation while minimizing potential recirculation of excess fluids back onto the HLP liners.

Coordination with O&M Activities Performed by ARC - An important consideration during operation of the pilot test is coordination of ongoing O&M activities at OU8. ARC performs O&M following an O&M Plan prepared in 2010 (Brown & Caldwell, 2010). O&M includes the following activities (Brown & Caldwell, 2016):

- Maintain and repair pond liners, anchor trenches and perimeter ditches;
- Conduct monthly monitoring of pond levels, inflow rates and pumping rates;
- Maintain leak detection systems and record leakage;
- Maintain flow meters, weir inflow level meters, and pond level transducers;
- Maintain EPA's bird deterrent system at the Arimetco FMS ponds
- Collect samples of drain-down solutions for lab analyses; and
- Report FMS activities and data including FMS solution transfer volumes, average drain-down rates and pond levels to EPA.

During the pilot test, ARC continued to perform the O&M activities described above. ARC continued to be responsible for regulating the fluid levels within the ponds. SPS was responsible for transferring fluids from the VLT pond to the evaporation panels on the VLT HLP. Modifications to the electrical system are documented on the existing electrical P&ID drawing (Appendix A).

Prior to construction of the pilot test, SPS and ARC attended a joint work session with the field operators and engineers of the FMS. During this meeting, minor adjustments to the pilot test design were made such that changes to ARC's existing O&M procedures were not required during operation of the pilot test.

7.0 Pilot Test Decommissioning

Decommissioning of the pilot system is underway with the purpose of returning the FMS system back to its pre-pilot configuration and preserving the evaporation components for possible future use. Shutdown includes draining the system and restoring all pre-pilot piping connections. The filter was removed and cleaned and will be stored for potential future use. The Bete heads will be kept in place on the riser pipes until a decision is made regarding a full-scale system. The auxiliary pump will be pulled, serviced, and stored. The Durco pump will be serviced for future use by ARC as a backup pump.

8.0 Pilot Test Results

8.1 Fluid Pumping Results

The pilot test was operated for 89 days between June 1, 2016 and September 30, 2016. A summary of the pumping results are provided in Table 8-1. Completed daily field observation forms are provided in Appendix C.

Table 8-1. Summary of Pilot Test Pumping

Date	Time Pumped (Minutes)	Volume Pumped (gal)	Pump rate (gpm)	Comments
5/26/2016	0	0		pre-startup
5/27/2016	15	1,450	97	Startup
5/31/2016				
MAY TOTAL	**15**	**1,450**	**97**	
6/1/2016	60	5,000	83	
6-/2/2016	60	5,000	83	estimate only, flow meter inop, pinhole pipe leak on liner
6/3/2016	128	15,900	124	first normal day, filter cleaned, flow meter moved DS of filter
6/6/2016	114	15,000	132	
6/7/2016	115	15,000	130	2 shifts at 7,500 gal each

Date	Time Pumped (Minutes)	Volume Pumped (gal)	Pump rate (gpm)	Comments
6/8/2016	75	10,000	133	
6/9/2016	73	10,000	137	
6/10/2016	74	10,000	135	
6/13/2016	79	10,000	127	
6/14/2016	81	10,500	130	Pinhole leak in perimeter ditch repaired
6/15/2016	15	1,500	100	High winds
6/16/2016	77	10,000	130	Replaced all Senninger heads with Bete heads
6/17/2016	74	10,000	135	
6/20/2016	76	10,300	136	
6/21/2016	0	0	0	Shutdown due to weld leak in perimeter ditch on liner
6/22/2016	18	2,000	111	Shutdown due to weld leak in perimeter ditch on liner
6/23/2016	155	20,400	132	Two sessions (morning/afternoon) weld leak fixed
6/24/2016	165	21,200	128	Two sessions (morning/afternoon)
6/25/2016	126	16,300	129	
6/26/2016	73	9,200	126	
6/27/2016	147	20,600	140	Two sessions (morning/afternoon)
6/28/2016	97	13,200	136	
6/29/2016	150	20,700	138	Two sessions (morning/afternoon)
6/30/2016	150	20,100	134	Two sessions (morning/afternoon)
JUNE TOTAL	**2,182**	**281,900**	**129**	
7/1/2016	77	10,400	135	
7/5/2016	151	19,700	130	Two sessions (morning/afternoon)
7/6/2016	152	19,600	129	Two sessions (morning/afternoon)
7/7/2016	146	20,000	137	two sessions (morning/afternoon)
7/8/2016	112	12,700	113	Two sessions, filter cleaned between sessions
7/11/2016	87	10,000	115	
7/12/2016	86	10,100	117	
7/13/2016	87	10,000	115	
7/14/2016	90	10,000	111	
7/15/2016	81	10,000	123	
7/18/2016	83	10,400	125	
7/19/2016	39	4,900	126	Aux pump trip
7/20/2016	97	11,200	115	
7/21/2016	85	10,000	118	Pinhole leak in perimeter ditch repaired, filter drain repaired
7/22/2016	82	10,000	122	
7/23/2016	82	9,000	110	
7/25/2016	86	10,900	127	

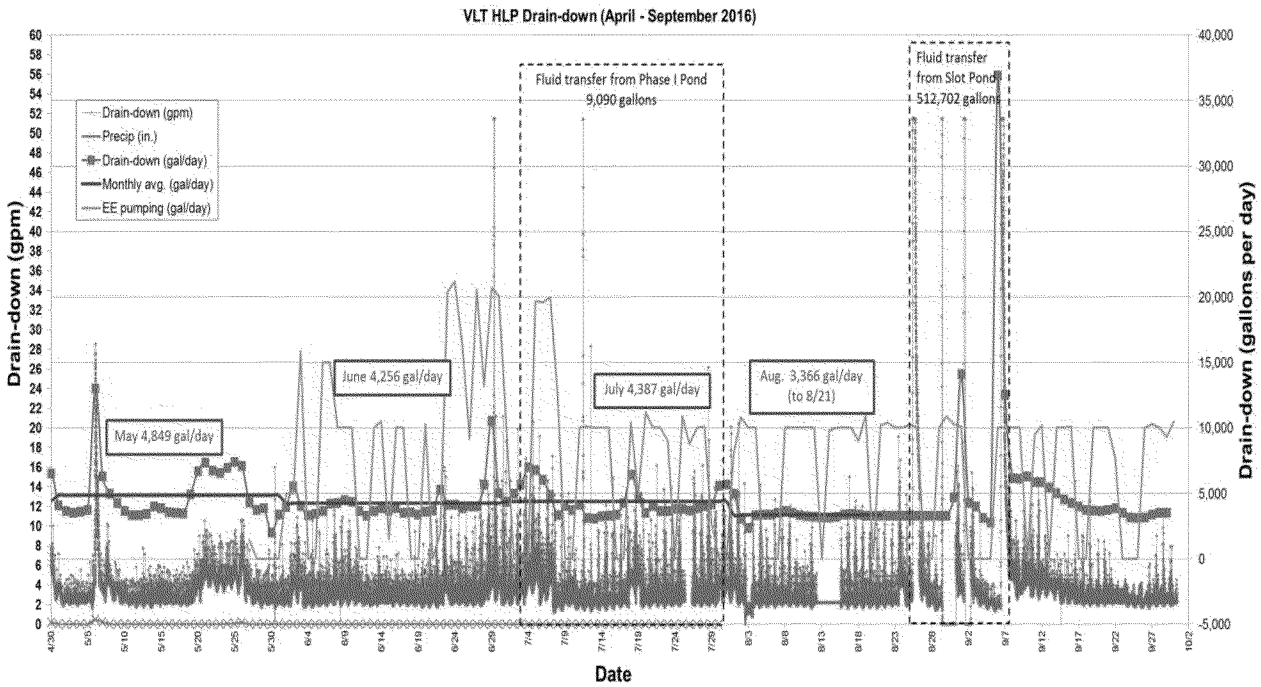
Date	Time Pumped (Minutes)	Volume Pumped (gal)	Pump rate (gpm)	Comments
7/26/2016	77	8,800	114	Aux pump trip
7/27/2016	86	10,000	116	
7/28/2016	81	10,100	125	
7/29/2016	26	2,700	104	Main pump trip
JULY TOTAL	**1,893**	**230,500**	**122**	
8/1/2016	67	8,000	119	Main pump trip, V1 replaced
8/2/2016	88	10,800	123	Oil added to main pump motor
8/3/2016	87	10,000	115	
8/4/2016	83	10,000	120	New breaker installed on main pump
8/8/2016	81	10,000	123	
8/9/2016	84	10,000	119	
8/10/2016	84	10,000	119	
8/11/2016	81	10,000	123	
8/12/2016	81	10,000	123	
8/14/2016	83	9,800	118	
8/15/2016	82	10,000	122	
8/16/2016	83	10,000	120	
8/17/2016	82	10,000	122	
8/18/2016	69	9,000	130	
8/19/2016	93	11,000	118	
8/21/2016	86	10,200	119	
8/22/2016	83	10,400	125	
8/23/2016	82	10,000	122	
8/24/2016	83	10,000	120	
8/25/2016	85	10,300	121	
8/26/2016	89	10,000	112	Brown & Caldwell began pumping from Slot to raise VLT level
8/29/2016	87	10,000	115	B&C continued pumping
8/30/2016	90	10,900	121	B&C continued pumping
8/31/2016	87	10,300	118	B&C continued pumping
AUG TOTAL	**2,000**	**240,700**	**120**	
9/1/2016	85	10,100	119	B&C continued pumping
9/2/2016				Paused evap pumping to let VLT level rise
9/5/2016				Paused evap pumping to let VLT level rise
9/6/2016	89	10,000	112	B&C continued pumping
9/7/2016	86	10,000	116	B&C continued pumping
9/8/2016	86	10,000	116	

Date	Time Pumped (Minutes)	Volume Pumped (gal)	Pump rate (gpm)	Comments
9/9/2016	82	10,000	122	
9/11/2016	84	9,500	113	
9/12/2016	88	10,200	116	
9/13/2016				Overcast, chance of rain, no pumping
9/14/2016	84	10,000	119	
9/15/2016	88	10,000	114	
9/16/2016	85	10,100	119	
9/19/2016	85	10,000	118	
9/20/2016	85	10,000	118	
9/21/2016	85	10,000	118	
9/22/2016	84	7,700	92	Low gpm, cold weather + higher humidity?
9/23/2016				Evap panels still wet from 9/22, cool day, no pumping
9/26/2016	87	10,000	115	
9/27/2016	86	10,300	120	
9/28/2016	85	10,000	118	
9/29/2016	87	9,300	107	
9/30/2016	88	10,500	119	
SEP TOTAL	**1,629**	**187,700**	**115**	
Total	**7,719**	**942,250**	**122**	

Given the pumping and piping configurations, the pilot system was operated at approximately 120 gpm. Fluid application rates between 5,000 gal/day to 20,000 gal/day were tested. Pumping typically occurred between noon and 2 PM each day to maximize evaporation. Multiple application cycles during a given day were also considered early in the pilot test. After observing performance of the system, it was decided that a single application of 120 gpm for 80 to 85 minutes was optimal. This resulted in a fluid application rate of approximately 10,000 gal/day. For the 4-month pilot test (89 operating days), the total fluid application was approximately 942,000 gallons, which results in an average fluid application rate of 10,584 gal/day or approximately 0.125 in/day of 'precipitation' over the area of the panels.

A summary of the pumping data is shown in Figure 8-1. Daily pumping rates are shown in blue. Weir flow data (drain-down) is shown in gpm (green) and gal/day (red). Times of fluid transfer from the slot pond to the VLT pond are also provided and are evident by the green spikes measured at the weir. It appears that some recirculation is likely to have occurred, in particular when the fluid application rate was 20,000 gal/day. However, by observing the red line, the drain-down rate to the VLT pond did not increase appreciably during the test.

Figure 8-1. Summary of Pumping During the Pilot Test



8.2 Estimate of Evaporation

In this section, both the natural and enhanced evaporation rates are estimated. This was done by comparing the inflow (weir) and outflow (pumping) rates and then using the pond elevation/volume curve to estimate the difference in fluid volume during the period of evaluation.

The period of evaluation was between Jun 1 and Aug 19, since after this time, fluids were transferred from the slot pond to the VLT pond so the elevation/volume curve would be affected by pumping and not usable for this comparison. This evaluation was also made possible, since there was no precipitation was measured during this period of time at the two nearby metrological stations.

A simple model to estimate natural and enhanced evaporation is shown in Figure 8-2 and the pond elevation vs. volume curve is shown in Figure 8-3. The equation used for this calculation is as follows:

Start Vol + Inflow - Enh Evap - Nat Evap = End Vol

Figure 8-2. Model to Estimate Natural and Enhanced Evaporation

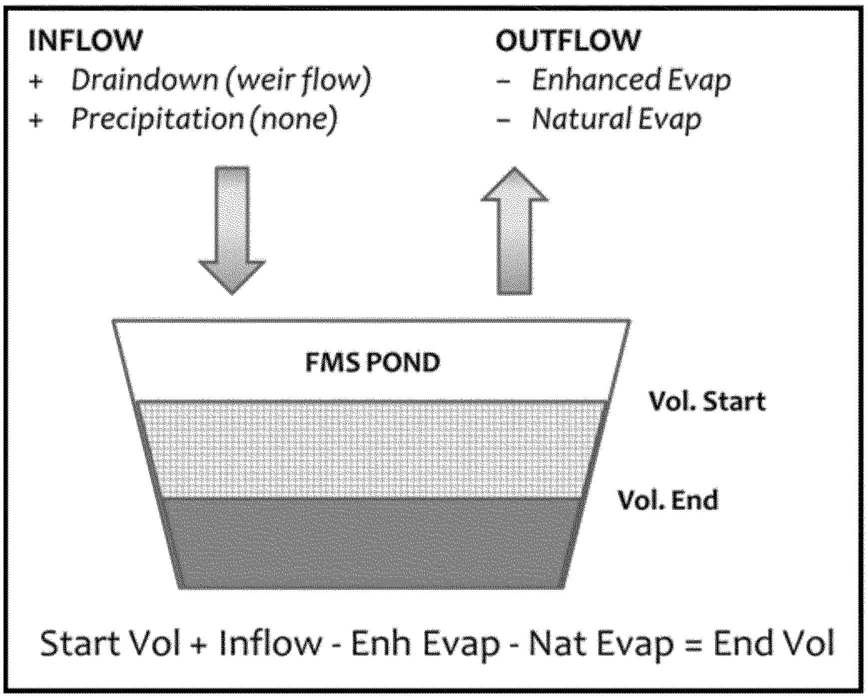
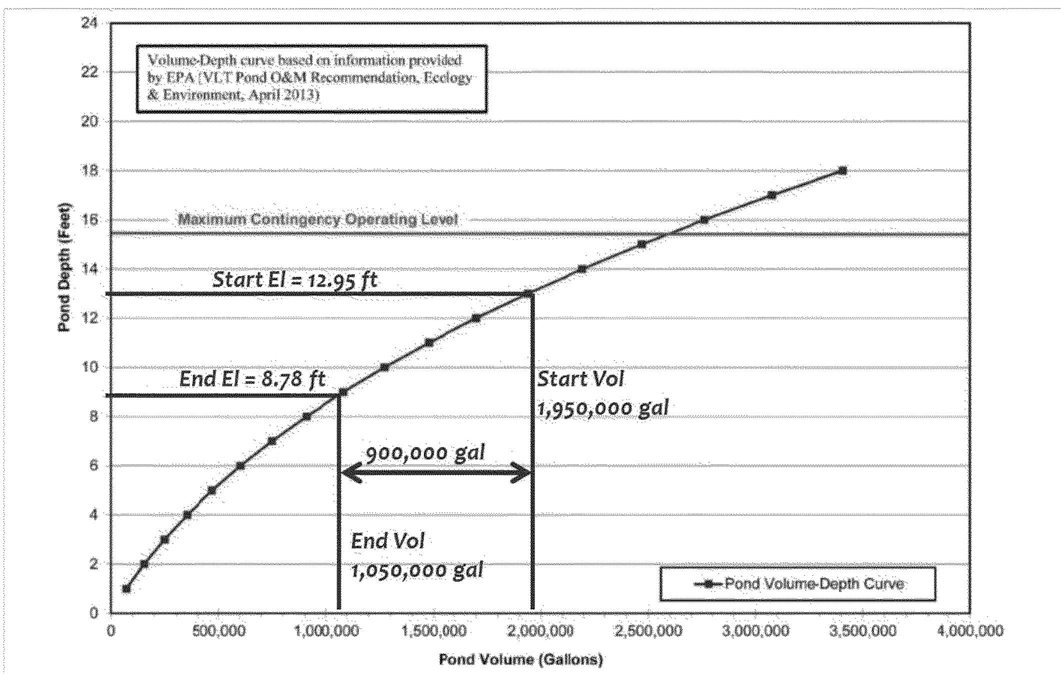


Figure 8-3. VLT Pond Elevation vs. Volume Curve



The table below summarizes the calculation of natural and enhanced evaporation using this equation. Based on this approach, it is estimated that approximately 46% of the evaporation that occurred during the pilot test was from natural evaporation and 54% was due to the enhanced evaporation system.

Table 8-2. Estimate of Natural and Enhanced Evaporation

Parameter	Source/Comment	Jun 1 thru Aug 19	
VLT pond start volume (gal)	From pond el/vol curve	1,950,000	
Inflow (gpm)	Measured from weir inflow	315,699	
	Precipitation - none	-	
	Recirculation	-	
Total VLT Fluids	Total VLT fluid, by addition	2,265,699	
VLT pond end volume (gal)	From pond el/vol curve	1,050,000	
Fluid Evaporation	Calculated by difference	1,215,699	
Outflow (gpm)	Enhanced evaporation	662,450	54%
	Nat Evap, calculated by difference	553,249	46%

A comparison of natural evaporation 2016 to 2015 was not feasible since the VLT pond fluid levels were kept very low during the period of July 15 thru Oct 15, 2015 to accommodate the hydraulic leak test of ponds B and C during that time.

8.3 Potential Recirculation of Fluids during the Pilot Test

The pilot test was designed with moisture sensors installed in the upper several feet of the VLT HLP as an early indication that fluids were not recirculating back to the liner system. However, due to the composition of the HLP material, the sensors did not provide reliable data.

The approach used to evaluate potential recirculation was to compare 2015 and 2016 weir flow data, while accounting for precipitation. The weir flow and precipitation data are summarized in Table 8-3.

Table 8-3. Summary of 2015 and 2016 Weir Flow Data

2015 Flow and Precipitation Data				
Month Ending	Precip (in)	VLT (gpm)	Slot (gpm)	Ph III (gpm)
1/31/2015	**0.25**	2.95	2.14	3.43
2/29/2015	**0.25**	2.85	2.50	1.96
3/31/2015	**0.25**	3.17	2.39	1.83
4/30/2015	**0.25**	2.57	2.29	2.11
5/31/2015	1.73	3.01	5.10	4.40
6/30/2015	1.04	3.36	4.00	3.48
7/31/2015	0.61	2.82	3.71	3.10
8/31/2015	0.26	2.97	3.49	3.19
9/30/2015	0.00	2.51	3.02	2.74
10/31/2015	0.78	2.47	2.64	4.89
11/30/2015	1.29	5.60	5.04	6.51
12/31/2015	0.27	4.50	3.32	3.87
Annual total (in)	6.98	3.23	3.30	3.46

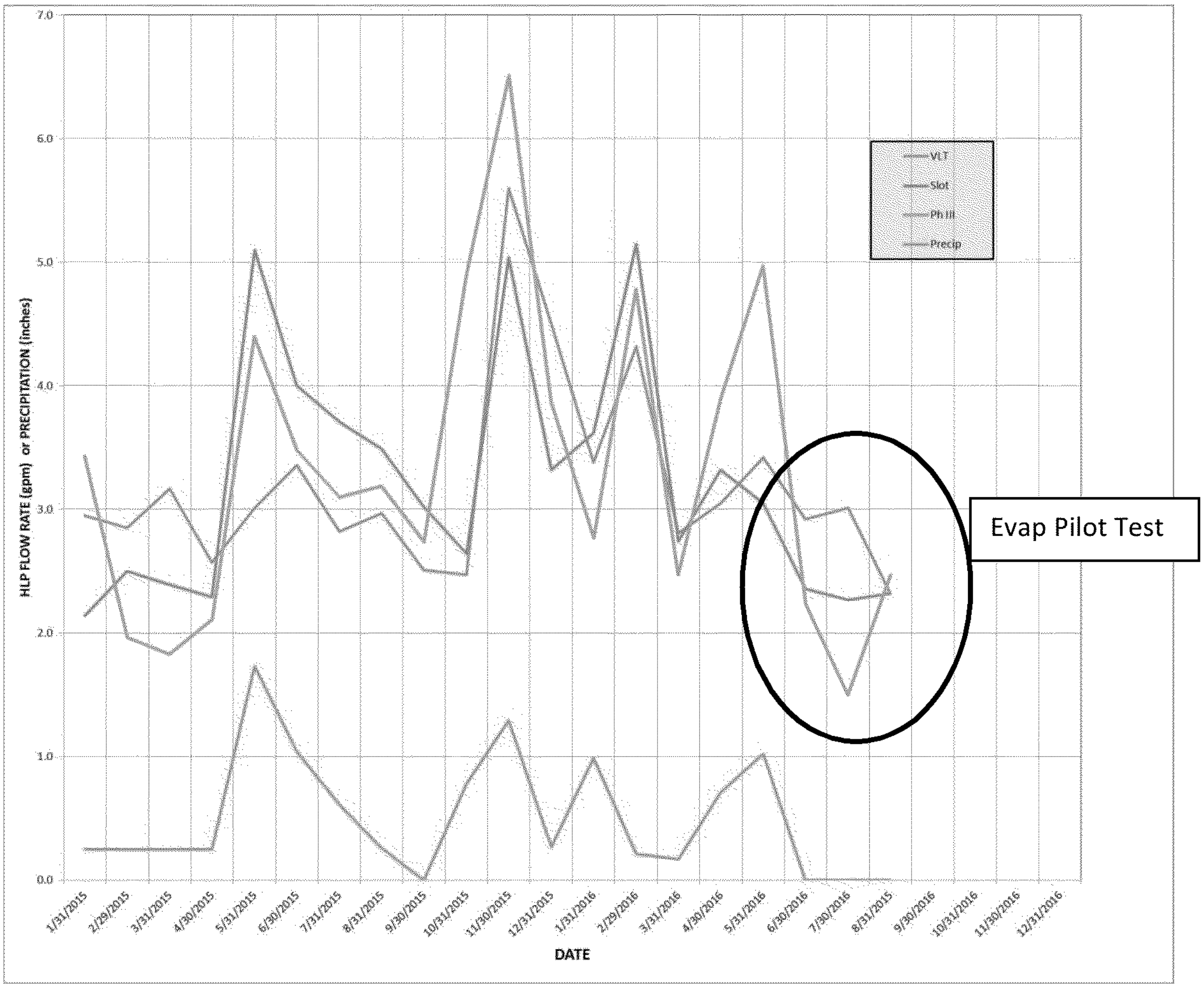
2016 Flow and Precipitation Data				
Month Ending	Precip (in)	VLT (gpm)	Slot (gpm)	Ph III (gpm)
1/31/2016	0.99	3.38	3.62	2.77
2/29/2016	0.21	4.32	5.15	4.78
3/31/2016	0.17	2.81	2.74	2.47
4/30/2016	0.71	3.05	3.32	3.9
5/31/2016	1.02	3.42	3.05	4.97
6/30/2016	0.00	2.92	2.36	2.23
7/30/2016	0.00	3.01	2.27	1.50
8/31/2015	0.00	2.32	2.32	2.47
9/30/2016	0.00	2.41	1.66	1.90
10/31/2016				
11/30/2016				
12/31/2016				
	3.10	3.07	2.94	3.00

The pilot test was operated during the months of May through Sept 2016 as highlighted in yellow in Table 8-3. During the 4-mo period of the pilot test in 2016 the average draindown rate from the VLT HLP was 2.67 gpm while the site received 0.00 inches of precipitation. During the same 4-mo period in 2015 the average draindown rate was 2.92 gpm while the site received 1.91 inches of precipitation. By comparing the draindown rates between 2015 and 2016, and accounting for differences in precipitation, the line of evidence indicates that the pilot test did not have a significant effect on the draindown rate at the VLT pond.

A second line of evidence to gain insight on the potential for recirculation from the pilot test is to compare the draindown rates at the Slot HLP and the Ph III HLPs during the same 4-month periods in 2015 and 2016. These data are also provided in Table 8-3. All of the weir flow data for 2015 and 2016 for the VLT, Slot and Ph III Heap Leach Pads, along with precipitation data are presented on Figure 8-4.

Figure 8-4 shows a clear correlation between weir flow and precipitation. However, there does not appear to be a strong indication of increased weir flow associated with the pilot test. Additional data for the remaining months of 2016 may be useful in better quantifying this conclusion.

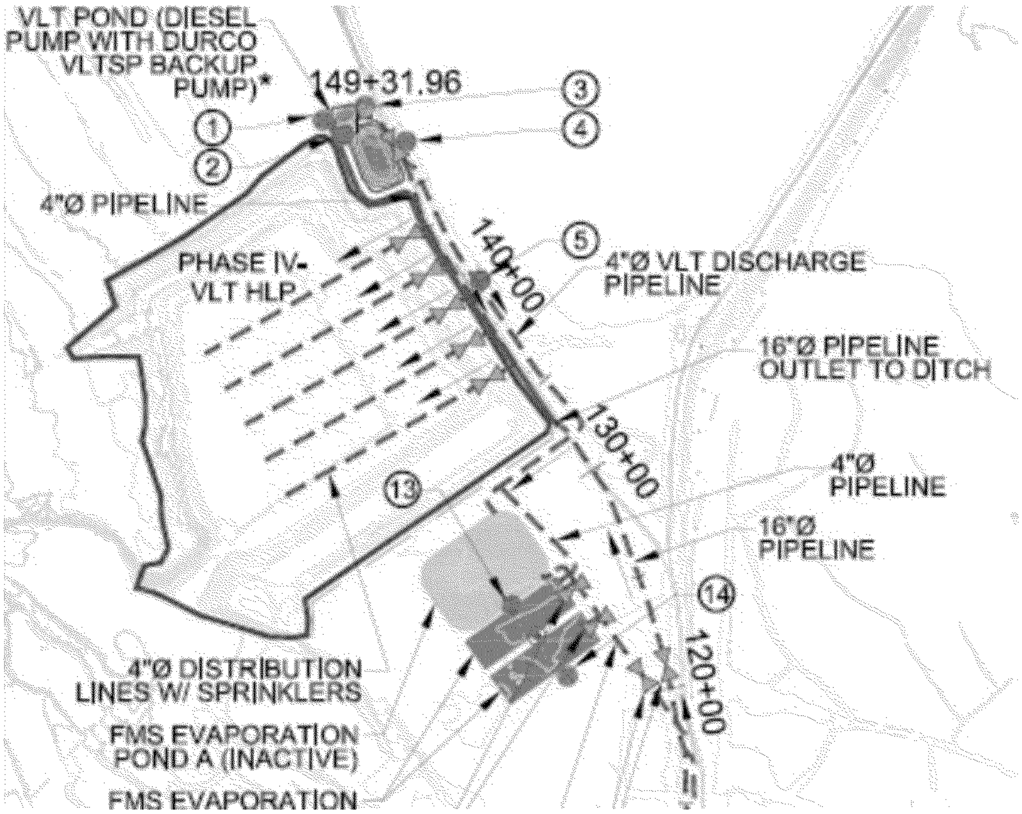
Figure 8-4. Summary of Weir Flow Data for 2015 and 2016



8.4 Leak Detector Data

The leak detector data collected at the VLT pond was also evaluated to assess potential recirculation from the pilot test. The location of the leak detectors at the VLT pond are shown on Figure 8-5.

Figure 8-5. VLT Leak Detector Locations

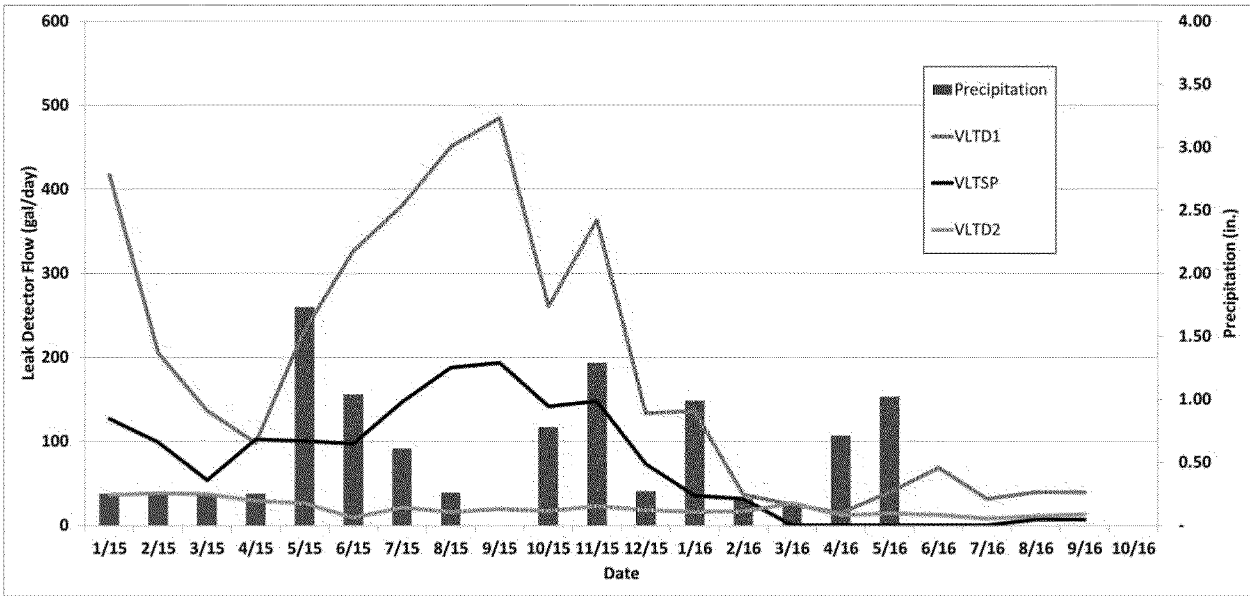


LEAK DETECTOR ID	LOCATION
1 VLT D1	DITCH BY WEIR NORTH
2 VLT D2	DITCH BY WEIR SOUTH
3 VLT SP	SEDIMENT POND
4 VLT P1	VLT POND

Historically, VLTD1, VLTD1, VLTSP have had some fluid present in the monthly data. VLTP1 and VLTD3 have historically always been dry. Figure 8-5 shows that over the past two years, there has been a strong decreasing trend in the volume of fluids measured in the leak detectors. The volume of fluid collected in the leak detectors does not appear to be correlated with precipitation, fluid transfers into the VLT pond or the enhanced evaporation pilot test.

Measurements at each of the VLT leak detectors and monthly precipitation are shown graphically on Figure 8-6. By comparing 2015 and 2016 data, as well as before and during the pilot test in 2016, it does not appear that the pilot test had a measurable effect on the amount of fluids collected in the VLT leak detectors.

Figure 8-6. VLT Leak Detector Data for 2015 and 2016



8.5 Total Dissolved Solids

Total Dissolved Solids (TDS) measurements were taken from the FMS ponds by ARC at various times before and during the pilot test. The results are provided in Table 8-4.

Table 8-4. Total Dissolved Solids (Brown & Caldwell, 2016)

Date Sampled	VLT Pond	Sample Name[1]	Sample Depth (ft, bpfs)	TDS (mg/L)
2/11/2016	VLT Pond	FMS-02/VLT Pond	1	110,000
2/23/2016	VLT Pond	FMS-02/VLT Pond	1	96,000
4/11/2016	VLT Pond	FMS-02/VLT Pond	1	120,000
		FMS-02/VLT Pond	1	130,000
		FMS-02/VLT Pond	1	140,000
		FMS-02/VLT Pond	1	130,000
4/26/2016	VLT Pond	VLT-1 (2)	2	150,000
		VLT-1 (6)	6	260,000
		VLT-1 (10)	10	230,000
		VLT-2 (2)	2	150,000
		VLT-2 (6)	6	250,000
		VLT-2 (10)	10	270,000
5/26/2016	VLT Pond	VLT-1 (2)	2	170,000
		VLT-1 (6)	6	260,000
		VLT-1 (10)	10	260,000
		VLT-2 (2)	2	190,000
		VLT-2 (6)	6	220,000
		VLT-2 (10)	10	220,000
6/21/2016	VLT Pond	VLT-1 (2)	2	200,000
		VLT-1 (6)	6	260,000
		VLT-1 (10)	10	230,000
		VLT-2 (2)	2	260,000
		VLT-2 (6)	6	250,000
		VLT-2 (10)	10	270,000
7/19/2016	VLT Pond	VLT-1 (2)	2	250,000
		VLT-1 (8)	8	220,000
		VLT-2 (2)	2	190,000
		VLT-2 (8)	8	210,000

Notes:
bpfs - below pond fluid surface
[1] Sample names prior to April 26,2019 were based on routine FMS Pond sampling

The effects of the pilot test on TDS results are somewhat difficult to quantify since the sample location and depths varied between the sampling events. In general, it appears that TDS increases with depth, although somewhat inconsistently. It also appears that TDS increases as the summer season progresses, but this is somewhat subjective since temporal variations of TDS are not available from prior years. This factor is further complicated since the VLT pond levels continued to decrease as the pilot test progressed due to both enhanced and natural evaporation.

Another consideration related to effects of the enhanced evaporation on TDS is related to the removal of solids that occur as a result of pumping associated with the pilot test. The fact that solids were removed from the VLT pond is obvious since buildup of solids on top of the HLP was observed to increase as the pilot test progressed.

One can estimate the amount (weight or volume) of solids removed from the VLT by the enhanced evaporation pilot test by multiplying the TDS by the volume of fluids pumped from the VLT pond during the test. Assuming an average TDS of the VLT pond of approximately 225,000 mg/l, and multiplying by the volume of fluids pumped from the pilot test (940,000 gal) represents approximately 1,765,000 lbs. (883.5 tons) of solids removed from the VLT pond due to the pilot test. Using the specific gravity of the solids estimated at approximately 127 lb/cu ft, (SPS, 2014), results in 13,900 cu ft (104,000 gal) of solids removed from the VLT pond from the pilot test. This volume of solids represents approximately 2.5 inches of precipitate buildup over the area of the pilot test, which is generally consistent with field observations.

The removal of solids from the VLT pond is only an estimate due to at least two factors. First, the amount of recirculation is not known with certainty and, second, the effects of potential fluid recirculation on TDS values are also not known. TDS of the ponds may increase as time goes on due to the effects of evaporation, both natural and enhanced. This hypothesis will be validated as future TDS measurements are taken at the VLT pond. Regardless of these uncertainties, the benefits of fluid and solids removal from the pilot test appear to outweigh the potential negative effects of higher TDS.

8.6 Water balance

The water balance for the FMS, including the effects of the pilot test will be updated in the annual O&M report prepared by ARC

9.0 Considerations for Full-Scale Enhanced Evaporation System

This section discusses how data from the pilot test could be used to design a full scale system capable of maintaining current FMS fluid capacity over a 10-yr period. Given ongoing uncertainty with NPL funding and discussions amongst ARC/NDEP/EPA/BLM for alternatives to NPL funding, additional discussion is required before a decision is made to proceed with a full scale system and these items are anticipated to become clearer in the upcoming months.

Design Criteria – Based on the performance of the pilot test, the key design criteria for a full-scale system are summarized below:

- Achieve evaporation of 1.5 to 2.0 M gal/yr
- Area required = 1.5x to 2x pilot scale, 8 panels, 3 acres total area
- 3 acres on top of VLT and/or Slot HLP
- 15,000 to 20,000 gal/day
- 0.125 in/day over the area of application
- 180 to 240 gpm
- 4 mo/yr, 5 day/wk, 1.5 hr/day, 80% run time
- New main pump
- 4- inch, SDR 11 HDPE piping
- 2-inch, SDR 11 header piping
- 1-inch schedule 40 PVC sprinkler risers
- Stainless steel Bete sprinkler heads

Key issues and mitigations that were identified before, and as a result of the pilot test, are summarized in Table 9-1.

Table 9-1. Summary of Issues Identified for the Evaporation Study (modified from SRK, 2013)

Issue	Mitigation
Rate of fluid application (system size	0.125 in/day, 2x pilot scale
Clogging of nozzles/sprinklers	Pilot demonstrated clogging is not an issue
Blinding of HLP surface *(Note 1)*	Beneficial, allows for more surface evaporation
Overspray	Shut down during excessive wind
Precipitate creates dust on HLPs	Shown not to create dust (Pond A)
Accessibility to top of HLPs	No issue, improved existing access roads
Stability of HLPs	No change to loading or stability of the HLPs is anticipated as a result of the evaporation pilot.
Operatorship of evaporation system	SPS operated the pilot test. Potential full scale system TBD
Total dissolved solids (TDS) buildup in pond	Removal of solids from FMS beneficial; potential EE effects on TDS ongoing, anticipated to be minor

Note 1: Blinding is defined as a significant reduction in infiltration on the surface of the HLP.

Capital and Operating Costs – One of the objectives of the pilot test was to provide costs for a full-scale system. The following summarizes the estimated capital and operating costs for a full-scale system.

Capital costs = $100k

- Grading ($10k)
- New main pump ($25k)
- New piping/valves (25k)
- Sprinkler heads ($5k)
- Electrical ($5k)
- Contingency ($30k)

OMM costs ($150k/yr)

- 2 FTE operators, 5 months ($80k/yr)
- Engineering support ($25k/yr)
- Reporting ($25k/yr)
- Contingency ($20k)

Schedule – If a decision is be made on whether to proceed with design, construction and operation of a full scale enhanced evaporation system, SPS estimates that it would take 2 months for final design and 2 months for construction. To maximize evaporation in a given season, a full scale system should be in place and operational by June 1. Below are the activities and schedule to achieve startup in 2017. Given the timing of ongoing activities, it is not likely to have a full season of evaporation in 2017.

Activity	Completion Date
Finalize Pilot Test Report	November 2016
Final decision regarding NPL Listing	March 2017
Negotiation of Agreements	Jan - Apr 2017
Decision to proceed with full-scale system	May 2017
Design and Procurement	June 2017
Construction	July 2017
Startup and Operation	July 2017

10 References

Brown & Caldwell, 2010, Arimetco Heap Leach Fluid Management System Operation and Maintenance Plan, Yerington Mine Site, Lyon County, Nevada. July 16, 2010

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CH2M HILL, 2012, Draft Final Feasibility Study for Arimetco Facilities Operable Unit 8 Heap Leach Pads and Drain-down Fluids Anaconda-Yerington Copper Mine, Yerington, Nevada, May 2012.

SPS, 2014, Cement Copper Evaluation, Yerington Anaconda Mine, September 25, 2014.

SPS, 2016, Work Plan for Enhanced Evaporation Pilot Test, Anaconda Mine Site, March 31, 2016.

SRK, 2013, Yerington Mine – Fluid Management System Study, April 2013